

## Patent claims

1. A method for recording microstructural changes in a component (1),  
5 in particular a layer system (1),  
by measuring at least one material parameter of the component (1) at least twice and in particular more than twice,  
using a measurement method to determine a material  
10 parameter selected from the group consisting of electrical capacitance, thermal conductivity, specific heat capacity, peltier coefficient, magnetic susceptibility, ferroelectricity, pyroelectricity, ultrasound or mechanical indenter test.  
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2. The method as claimed in claim 1,  
characterized in that  
  
the first measurement of the at least one material  
20 parameter is carried out on a newly produced component (1).
3. The method as claimed in claim 1 or 2,  
characterized in that  
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the first measurement is carried out before the first operational use of the component.
4. The method as claimed in claim 1, 2 or 3,  
30 characterized in that  
  
the at least second measurement takes place at a time interval after the first measurement, after or during initial operational use.  
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5. The method as claimed in claim 1, 2, 3 or 4,  
characterized in that

the method includes a nondestructive measurement method.

6. The method as claimed in claim 1,  
characterized in that

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the method is carried out using a layer system (1)  
which comprises a substrate (4) and at least one layer (7,  
10).

- 10 7. The method as claimed in claim 1 or 6,  
characterized in that

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the method is carried out using a layer system (1)  
which comprises a substrate (4), at least one first layer  
(7) and an outer layer (10).

8. The method as claimed in claim 6 to 7,  
characterized in that

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the method is used to examine microstructural changes in  
the substrate (4) and/or the layer (7, 10) of the  
component (1),  
which are caused by changes of precipitations in the  
material of the substrate (4) and/or the at least one  
layer (7, 10).

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9. The method as claimed in one or more of claims 6 to 8,  
characterized in that

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the method is used to examine microstructural changes in  
the substrate (4) and/or the layer (7, 10) of the  
component (1),  
which are caused by cracks in the substrate (4) and/or the  
at least one layer (7, 10).

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10. The method as claimed in one or more of claims 6 to 9,  
characterized

in that the substrate (4) and/or the layer (7, 10) is an alloy, and

5 in that the method is used to examine microstructural changes in the substrate (4) and/or the layer (7, 10), which are caused by depletion of at least one alloying element.

11. The method as claimed in one or more of claims 6 to 10, characterized in that

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the method is used to examine microstructural changes in the substrate (4) and/or the at least one layer (7, 10), in particular a porous ceramic layer (10), which are caused by sintering-up of the porous substrate  
15 (4) and/or the layer (7, 10).

12. The method as claimed in one or more of claims 6 to 11, characterized in that

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the method is used to examine microstructural changes in the substrate (4) and/or the at least one layer (7, 10), which are caused by a phase change in the material of the substrate (4) and/or the at least one layer (7, 10).

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13. The method as claimed in claim 1 to 12, characterized in that

the thermal conductivity ( $\lambda$ ) is determined by a laser flash method or by a thermal wave analysis.

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14. The method as claimed in claim 1 to 13, characterized in that

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the material parameter of the substrate (4) is determined with layer (7, 10) present on the substrate (4).

15. The method as claimed in claim 1 to 13,

characterized in that

a material parameter of the substrate (4) and the layer (7, 10) together is determined.

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16. The method as claimed in claim 1, 6, 7 or 10, characterized in that

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the method is carried out using a substrate (4) made from an iron-base, cobalt-base or nickel-base superalloy.

17. The method as claimed in claim 1, 6, 7, 10 or 12, characterized in that

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the method is carried out using a layer system (1), the layer (7) having the composition of an MCrAlX layer, where M stands for at least one element selected from the group consisting of iron, cobalt or nickel, and X stands for yttrium, silicon and/or at least one rare earth element.

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18. The method as claimed in claim 1, characterized in that

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the method is carried out using a component (1) of a gas turbine (100) or steam turbine (300, 303), in particular a turbine blade or vane (120, 130, 354, 357) or a lining of a combustion chamber (110).

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19. The method as claimed in claim 1, characterized in that

the measurement of the material parameters is carried out on line.

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20. The method as claimed in claim 1 or 2, characterized in that

beyond a defined percentage change in the material parameter, a time is laid down beyond which the component (1) needs to be inspected, refurbished or completely replaced.

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21. The method as claimed in claim 1 or 18, characterized in that

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the component (1, 120, 130) is a component of an apparatus (100, 300, 303), and  
in that the material parameter is measured while the component (1, 120, 130) is installed in the apparatus (100, 300, 303).